267-64.15 AU 315 47108

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1241337 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale

Fig.1.

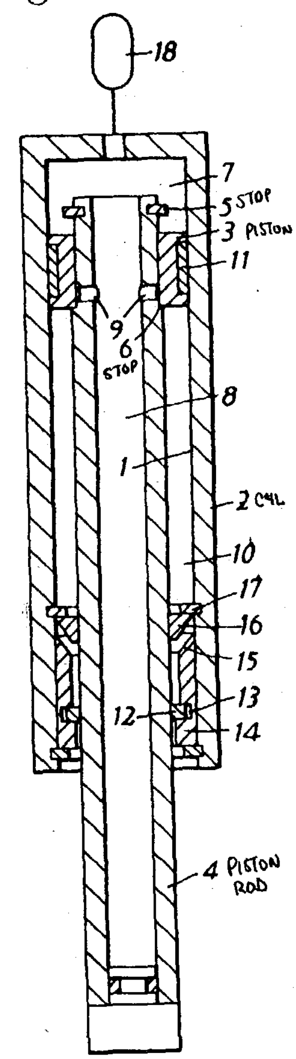
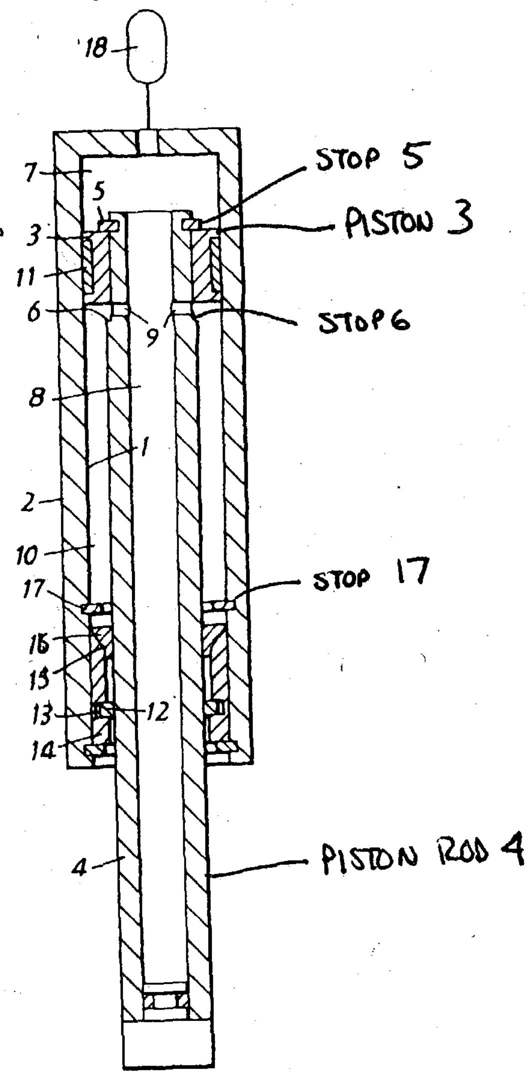


Fig.2.



the piston, and

Fig. 2 is the same suspension unit during outward displacement of the piston.

Referring to the drawing, a piston 3 is slidable in the bore 1 of a cylinder 2 between two stops 5 and 6 on a piston rod 4. The piston rod 4 has an axial bore 8 which communicates with the cylinder chamber 7, and which also communicates through a transverse bore 9 with an annular chamber 10 between the cylinder and piston rod when the position of the piston permits. The outer periphery of the piston 3 carries a seal 11. An outer seal 12 contained in a groove 13 formed in a sleeve 14 which is a press fit in the bore 1 seals the annular chamber 10 from the outside atmosphere. The sleeve 14 has a coned end face 15 which serves as a seating for a coned seal 16. Movement of the coned seal 16 into the cylinder 2 is limited by a stop 17. The cylinder chamber 7 is connected to a gas-hydraulic accumulator 18.

The described suspension unit functions as follows:—

Taking the position illustrated in Fig. 2 as the starting position, inward displacement of the piston rod 4 will reduce the capacity of the cylinder chamber 7. The resultant pressure rise forces some of the fluid into the accumulator 18. This pressure is also transmitted through the bore 8 and the transverse bore 9 into the annular chamber 10 where it increases the pressure which presses the coned seal 16 into its seating 15, the tightness of the seal being thereby improved. Only the normal system pressure acts on the outer seal 12. During this displacement of the piston rod 4 the position of the piston 3 in the cylinder 2 remains substantially unchanged, since the friction between the seal 11 and the cylinder 2 exceeds that of the piston 3 on the piston rod 4. The ensuing relative motion between the piston 3 and the piston rod 4 results in the transverse bore 9 in the piston rod 4 being covered by the piston 3 when a given relative displacement has taken place. Further inward motion of the piston rod 4 continues the build-up of pressure inside the cylinder chamber 7 but this cannot now be transmitted into the annular chamber 10. Since eventually the piston 3 will be entrained by the stop face 6 on the piston rod 4, the capacity of the annular chamber 10 increases to create a vacuum pressure inside this chamber. The coned seal 16 will therefore now be lifted off its seating and the position will be that illustrated in Fig. 1. The outer seal 12 will also cease to be under pressure. When the piston rod 4 moves in the opposite direction the piston 3 will first participate in the movement of the piston rod 4 because the pressure in the cylinder chamber 7 considerably exceeds the vacuum pressure in the annular chamber 10, and the difference in friction between the piston 3 and the cylinder 2 and that between the piston 3 and the cylinder 4 will at first have no effect. Moreover, the coned seal 16 will be entrained by the piston rod 4 until it comes to rest in its seating, because the pressures acting on opposite sides of the coned seal 16 are equal. However, in the course of the continued descent of the piston rod 4 the pressures in the cylinder chamber 7 and in the annular chamber 10 will eventually become equal. Owing to the above-described difference between the frictional forces the piston 3 will now slide on the piston rod 4 until intercepted by the stop 5, thereby uncovering the transverse bore 9 and restoring the position shown in Fig. 2. At first the pressure acting on the outer seal 12 will be slight but this may rise to the system pressure owing to leakage oil forcing its way past the coned seal 16. However, any renewed inward displacement of the piston rod 4 will at once reduce this pressure in the manner that has been described so that the period during which the seal is actually under pressure will be substantially shortened.

WILL NOT CREATE A VACUUM, BUT P WILL DECREASE IN DIRECTLY INVERSELY PROPORTION TO THE ΔV.

WELL, IT WILL AVOID BEING UNDER GREAT PRESSURE.

In a modification of the illustrated embodiment the piston may naturally be fast on the piston rod and the seal itself arranged to be movable. The shape and material of the seals can be freely chosen, so long as the described requirements with respect to tightness, frictional behaviour and movability between two stops are satisfied. The choice of the type and form of the stops is likewise discretionary. Furthermore, check valves, throttling check valves or like devices could be incorporated in the connection between the cylinder chamber and the annular chamber for the purpose of providing different flow resistances in the two directions of flow.

WHAT I CLAIM IS:—

1. A piston and cylinder unit suitable for use in a hydraulic and/or pneumatic system, for example as a hydro-pneumatic vehicle suspension strut or a shock absorber, and having a seal between the piston and the cylinder, a further seal between the piston rod and the cylinder, and a communicating channel between the cylinder chamber on the side of the piston remote from the piston rod and the annular chamber surrounding the piston rod, wherein the piston rod seal comprises an outer seal preceded by a coned inner seal, the coned inner seal being movable in the cylinder between a coned seating spaced axially away from the outer seal into the cylinder interior and a stop which is spaced axially

still further away from the outer seal, whereas the piston seal is movable in relation to the piston and piston rod between two stops, or the piston together with its seal is itself movable on the piston rod between two stops, the movement in either case being effective to cover said communicating channel when the piston rod moves inwards and to uncover the communicating channel when the piston rod moves outwards, the sliding friction between the piston seal and the piston or between the piston and the piston rod being lower than the sliding friction between the piston seal or piston and the cylinder, whereas the friction between the coned seal and the piston rod exceeds that between the coned seal and the cylinder.

2. A piston and cylinder unit for a hydro-pneumatic vehicle suspension system, constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawing.

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PATENT SPECIFICATION

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DRAWINGS ATTACHED

1 241 337

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(54) A PISTON AND CYLINDER UNIT

(71) I, VIKTOR LANGEN, a German citizen, trading as LANGEN & Co., of Klosterstrasse 49, 4 Dusseldorf, Germany, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to a piston and cylinder unit suitable for use in a hydraulic and/or pneumatic system, for example as a hydro-pneumatic vehicle suspension strut or a shock absorber, and having a seal between the piston and the cylinder, and a further seal between the piston rod and the cylinder.

It is well known that gas-hydraulic suspension units or shock absorbers require extremely tight seals, since leakage oil loss can be made good automatically only by the provision of a level control. In such cases the leakage oil is sometimes returned into the container through supplementary pipe means. If a level control is absent or if it is desired to do without a leakage oil pipe, then every effort must be made to provide the tightest possible seals. Seals hitherto used all have the drawback that the pressure to which they are exposed is proportional to the system pressure. Although major leakage loss can be avoided, despite the build-up of relatively high pressures, by using lipped seals, contact pressure between the seal and the piston or piston rod is nevertheless thereby increased and a higher rate of wear is the result.

PURPOSE

The object of the invention is the provision of a piston and cylinder unit in which the piston rod seal is relieved of pressure when the piston is rapidly thrust into the cylinder, for instance by irregularities in the road on which the vehicle rides in the case of piston and cylinder units used as spring suspension struts.

According to the present invention there is provided a piston and cylinder unit having a seal between the piston and the cylinder, a further seal between the piston rod and the cylinder, and a communicating channel between the cylinder chamber on the side of the piston remote from the piston rod and the annular chamber surrounding the piston rod, wherein the piston rod seal comprises an outer seal preceded by a coned inner seal, the coned inner seal being movable in the cylinder between a coned seating spaced axially away from the outer seal into the cylinder interior and a stop which is spaced axially still further away from the outer seal, whereas the piston seal is movable in relation to the piston and piston rod between two stops, or the piston together with its seal is itself movable on the piston rod between two stops, the movement in either case being effective to cover said communicating channel when the piston rod moves inwards and to uncover the communicating channel when the piston rod moves outwards, the sliding friction between the piston seal and the piston or between the piston and the piston rod being lower than the sliding friction between the piston seal or piston and the cylinder, whereas the friction between the coned seal and the piston rod exceeds that between the coned seal and the cylinder.

The advantage afforded by this arrangement is that in the course of major inward displacement of the piston, when said communication is closed, a vacuum pressure is generated in the annular chamber which relieves the pressure on the piston rod seal. This means that the piston rod seal need function only at normal or slightly increased system pressure.

An embodiment of the invention is schematically shown by way of example in the accompanying drawing in which:

Fig. 1 is a hydro-pneumatic vehicle suspension unit during inward displacement of